

Appendix E

Impact Assessment Methods

This appendix briefly describes the methods used to assess the potential direct, indirect, and cumulative effects of the alternatives in the *Mercury Management Environmental Impact Statement* (MM EIS). Included are impact assessment methods for air quality, noise, waste management, socioeconomics, risk, geology and soils, water resources, ecological resources, cultural resources, land use and visual resources, infrastructure, environmental justice, and cumulative impacts. Each section includes a description of the affected resource and the impact assessment method. The method used for the cost-benefit analysis is also described in this appendix. Detailed descriptions of the methods for the evaluation of human health and ecological risk from normal operations, facility accidents, and transportation are presented in the *Draft Human Health and Ecological Risk Assessment Report for the Mercury Management Environmental Impact Statement (Draft Risk Assessment Report)* (DLA 2003).

Methods for assessing environmental impacts vary for each resource area. For air quality, for example, pollutant emissions from the mercury management activities were evaluated for their effect on ambient concentrations and compliance with ambient standards. For human health risk, estimated mercury exposure to humans from the evaluated alternatives was compared with exposure limits. Comparison with regulatory standards is a commonly used method for benchmarking environmental impacts and is done here to provide perspective on the magnitude of identified impacts. Impacts in all resource areas were analyzed consistently; that is, the impact values were estimated using a consistent set of input variables and computations. Moreover, efforts were made to ensure that calculations in all areas used accepted protocols and up-to-date models.

E.1 AIR QUALITY

E.1.1 Description of Affected Resources

Air pollution refers to the introduction, directly or indirectly, of any substance into the air that could endanger human health and harm living resources and ecosystems, as well as material property, and impair or interfere with the comfortable enjoyment of life and other legitimate uses of the environment. For the purpose of the MM EIS, only outdoor air pollutants were addressed. They may be in the form of solid particles, liquid droplets, gases, or a combination of these forms. Generally, they can be categorized as primary pollutants (those emitted directly from identifiable sources) and secondary pollutants (those produced in the air by interaction between two or more primary pollutants, or by reaction with normal atmospheric constituents that may be influenced by sunlight). Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Thus, air quality is affected by air pollutant emission characteristics, meteorology, and topography.

Ambient air quality in a given location can be described by comparing the concentrations of various pollutants in the atmosphere with the appropriate standards. Ambient air quality standards have been established by Federal and state agencies, allowing an adequate margin of safety for the protection of public health and welfare from the adverse effects of pollutants in the ambient air. Pollutant concentrations higher than the corresponding standards are considered unhealthy; those below such standards are acceptable.

The pollutants of concern are primarily those for which Federal and state ambient air quality standards have been established, including criteria air pollutants, hazardous air pollutants, and other toxic air compounds. Criteria air pollutants are those listed in Title 40 of the Code of Federal Regulations (CFR) Part 50, "National Primary and Secondary Ambient Air Quality Standards": sulfur dioxide, particulate

matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), carbon monoxide, ozone, nitrogen dioxide, and lead. Hazardous air pollutants and other toxic compounds are those listed in Title I of the Clean Air Act, as amended, those regulated by the National Emissions Standards for Hazardous Air Pollutants, and those that have been proposed or adopted for regulation by the respective state, or are listed in state guidelines. States may set ambient standards that are more stringent than the national ambient air quality standards. The more stringent of the Federal or state standards for each site is used in the MM EIS. Standards for pollutants of concern are summarized in Table E-1. Also of concern are air pollutant emissions that may contribute to the depletion of stratospheric ozone and global warming.

Table E-1. Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS ($\mu\text{g}/\text{m}^3$) ^a	Indiana ($\mu\text{g}/\text{m}^3$)	New Jersey ($\mu\text{g}/\text{m}^3$)	Ohio ($\mu\text{g}/\text{m}^3$)	Tennessee ($\mu\text{g}/\text{m}^3$) ^b
Carbon monoxide	8 hours	10,000	(c)	(c)	(c)	(c)
	1 hour	40,000	(c)	(c)	(c)	(c)
Nitrogen dioxide	Annual	100	(c)	(c)	(c)	(c)
Lead	Quarterly	1.5	(c)	(c)	(c)	(c)
Ozone	8 hours	157	(d)	(d)	(d)	(d)
	1 hour	235	(c)	160	240	(c)
PM_{10}	Annual	50	(c)	NS	(c)	(c)
	24 hours	150	(c)	NS	(c)	(c)
$PM_{2.5}$	Annual	15	(d)	(d)	(d)	(d)
	24 hours	65	(d)	(d)	(d)	(d)
Sulfur dioxide	Annual	80	(c)	60	(c)	(c)
	24 hours	365	(c)	260	(c)	(c)
	3 hours	1,300	(c)	(c)	(c)	(c)
TSP	Annual ^e	NS	75	60	NS	NS
	24 hours	NS	150	150	NS	150

^a Short-term NAAQS, other than those for ozone, particulate matter, and lead, are not to be exceeded more than once per year. Annual standards are not to be exceeded. The 1-hour ozone standard applies only to nonattainment areas. Requirements for compliance with the standards are described in detail in the regulations.

^b Tennessee has additional standards for hydrogen fluoride and hydrogen chloride.

^c State standard is the same as the NAAQS.

^d The state has not yet adopted the NAAQS for $PM_{2.5}$ or the 8-hour ozone standard.

^e Annual geometric mean.

Key: NAAQS, National Ambient Air Quality Standards; NS, no standard; $PM_{2.5}$, particulate matter with an aerodynamic diameter less than or equal to 2.5 microns; PM_{10} , particulate matter with an aerodynamic diameter less than or equal to 10 microns; TSP, total suspended particulate.

Source: 40 CFR 50; Indiana 2001; New Jersey 1991; Ohio 1972, 1981, 1987, 1991, 1996; Tennessee 1997.

Areas with air quality better than the National Ambient Air Quality Standards (NAAQS) for criteria air pollutants are designated as being in attainment, while areas with air quality worse than the NAAQS for such pollutants are designated as nonattainment. Areas may be designated as unclassified when sufficient data for attainment status designation are lacking. Attainment status designations are assigned by county, metropolitan statistical area, consolidated metropolitan statistical area, or portions thereof, or air quality control regions. Air quality control regions designated by the U.S. Environmental Protection Agency (EPA) are listed in 40 CFR 81, "Designation of Areas for Air Quality Planning Purposes."

For locations that are in an attainment area for criteria air pollutants, prevention of significant deterioration regulations limit pollutant emissions from new or modified sources and establish allowable increments of pollutant concentrations. Three prevention of significant deterioration classifications are specified with the criteria established in the Clean Air Act. Class I areas include national wilderness areas, memorial parks larger than 5,000 acres (2,020 ha), national parks larger than 6,000 acres (2,430 ha), and areas that have been redesignated as Class I. Class II areas are all areas not designated as Class I. No Class III areas have been designated (42 U.S.C. 7472:Title I, Section 162).

The region of influence for air quality encompasses an area surrounding a site that is potentially affected by air pollutant emissions caused by the alternatives. The air quality impact area normally evaluated is the area in which concentrations of criteria pollutants would increase more than a significant amount in a Class II area (i.e., on the basis of averaging period and pollutant: $1 \mu\text{g}/\text{m}^3$ annually for sulfur dioxide, PM_{10} , and nitrogen dioxide; $5 \mu\text{g}/\text{m}^3$ of sulfur dioxide and PM_{10} for 24 hours, $500 \mu\text{g}/\text{m}^3$ of carbon monoxide for 8 hours, $25 \mu\text{g}/\text{m}^3$ of sulfur dioxide for 3 hours, and $2,000 \mu\text{g}/\text{m}^3$ of carbon monoxide for 1 hour [40 CFR 51.165]). Generally, this covers a few miles downwind from the source. Further, for sources within 60 mi (100 km) of a Class I area, the air quality impact area evaluated would include the Class I area if the increase in concentration were greater than $1 \mu\text{g}/\text{m}^3$ (24-hr average). The area of the region of influence depends on emission source characteristics, pollutant types, emission rates, and meteorological and topographical conditions. For the purpose of this analysis, impacts were evaluated at the site boundary and roads within the sites to which the public has access, plus any additional areas on or off site in which contributions to pollutant concentrations are expected to be at maximum or exceed significance levels.

Baseline air quality is typically described in terms of pollutant concentrations modeled for existing sources at each potential site and background air pollutant concentrations measured near the sites. For this analysis, concentrations for existing sources were obtained from existing source documents such as preliminary assessments, site investigations, environmental impact statements, annual environment reports and from the U.S. Environmental Protection Agency database for nearby monitoring sites. These concentrations were compared with Federal and state standards or guidelines (Table E-1).

E.1.2 Description of Impact Assessment

Potential air quality impacts of pollutant emissions from facility modifications and normal operations were evaluated for each of the alternatives (Table E-2). All of the alternatives considered had minor emissions from onsite activities, which were discussed qualitatively. Transportation emissions were evaluated by comparing traffic generated from each of the alternatives with existing traffic levels.

The Clean Air Act, as amended, required that Federal actions conform to the host state's "state implementation plan." A state implementation plan provides for the implementation, maintenance, and enforcement of NAAQS for the six criteria pollutants. Its purpose is to eliminate or reduce the severity and number of violations of NAAQS and to expedite the attainment of these standards. No department, agency, or instrumentality of the Federal Government shall engage in or support in any way (i.e., provide financial assistance for, license or permit, or approve) any activity that does not conform to an applicable implementation plan. The final rule for "Determining Conformity of General Federal Actions to state or Federal Implementation Plans" (58 FR 63214) took effect on January 31, 1994. Areas currently designated as attainment for criteria air pollutants are not affected by the provisions of the conformity rule. Applicability of the conformity rule was assessed for each site. Because all the sites are in attainment areas except the area around the Somerville Depot, no additional conformity analysis is required for the sites in attainment areas. If emissions of ozone precursors (nitrogen oxides and volatile organic compounds) for the alternatives at the Somerville Depot are below 50 tons/yr (45 metric tons/yr)

a conformity determination is not required (40 CFR 51.853). Emissions of nitrogen oxides and volatile organic compounds are expected to be less than 0.1 tons/yr (0.1 metric tons/yr) for all the alternatives, so no further conformity analysis is required.

Table E–2. Impact Assessment Protocol for Air Quality

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Criteria air pollutants and other regulated pollutants ^a	Measured ambient concentrations near the site	Emission (kg/yr) of air pollutants from facility;	Change in concentration due to alternative for each pollutant at or beyond site boundary, and change in vehicle emissions based on estimate of vehicle trips
	Measured and modeled concentrations ($\mu\text{g}/\text{m}^3$) from existing sources at site	source characteristics (e.g., stack height and diameter, exit temperature and velocity); vehicle trips	
Toxic and hazardous air pollutants ^b	Measured ambient concentrations near the site	Emission rate (kg/yr) of pollutants from facility;	Change in concentration due to alternative for each pollutant at or beyond site boundary
	Measured and modeled concentrations ($\mu\text{g}/\text{m}^3$) from existing sources at site	source characteristics (e.g., stack height and diameter, exit temperature and velocity)	

^a Carbon monoxide; lead; nitrogen oxides; ozone; particulate matter with an aerodynamic diameter less than or equal to 10 microns; particulate matter with an aerodynamic diameter less than 2.5 microns; sulfur dioxide; and total suspended particulates.

^b Clean Air Act Section 112, “Hazardous Air Pollutants,” pollutants regulated under the National Emissions Standard for Hazardous Air Pollutants and other state-regulated pollutants.

Emissions of potential stratospheric ozone-depleting compounds such as chlorofluorocarbons were not evaluated, as no emissions of these pollutants were identified in the mercury management alternatives.

E.2 NOISE

E.2.1 Description of Affected Resources

Sound results from the compression and expansion of air or some other medium when an impulse is transmitted through it. Sound requires a source of energy and a medium for transmitting the sound wave. Propagation of sound is affected by various factors, including meteorology, topography, and barriers. Noise is undesirable sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities (e.g., hearing, sleep), damage hearing, or diminish the quality of the environment.

Sound-level measurements used to evaluate the effects of nonimpulsive sound on humans are compensated by an A-weighting scale that accounts for the hearing response characteristics (i.e., frequency) of the human ear. Sound levels are expressed in decibels, or in the case of A-weighted measurements, decibels A-weighted. EPA has developed noise-level guidelines for different land-use classifications. Some states and localities have established noise-control regulations or zoning ordinances that specify acceptable noise levels by land-use category.

Noise from facility operations and associated traffic could affect human and animal populations. The region of influence for each candidate site includes the site and surrounding area, including transportation corridors, where proposed activities might increase noise levels. Transportation corridors most likely to experience increased noise levels are those roads within a few miles of the site boundary that carry most of the site’s employee and shipping traffic.

Sound-level data representative of site environs were obtained from existing reports. The acoustic environment was further described in terms of existing noise sources for each candidate site and traffic volumes on access routes.

E.2.2 Description of Impact Assessment

Noise impacts associated with the alternatives may result from normal operations, as well as increased traffic (Table E-3). Impacts from operations were assessed according to the types of noise sources and the location of the mercury management facilities relative to the site boundary and noise sensitive receptors. Potential noise impacts from traffic were assessed based on the likely increase in traffic volume. Possible impacts to wildlife were evaluated based on the possibility of sudden loud noises occurring during facility operations.

Table E-3. Impact Assessment Protocol for Noise

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Noise	Identification of sensitive offsite receptors (e.g., nearby residences, nearby threatened and endangered wildlife habitat); description of sound levels and noise sources in the vicinity of the site	Description of operational noise sources; shipment and workforce traffic estimates	Increase in day/night average sound level at sensitive receptors

E.3 WASTE MANAGEMENT

E.3.1 Description of Affected Resources

Both hazardous and nonhazardous wastes can be expected to be generated in the process of storing and maintaining the strategic stockpile of mercury. Because waste materials contaminated with mercury above regulatory limits are regulated as a hazardous waste under the Resource Conservation Recovery Act (RCRA), mercury wastes will need to be disposed of in accordance with RCRA regulations. Other waste materials that would be generated would be classified as nonhazardous waste. Definitions of these waste types are as follows:

- **Hazardous**—Under RCRA, a waste that, because of its characteristics, may (1) cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous wastes appear on special EPA lists or possess at least one of the following characteristics: ignitability, corrosivity, reactivity, or toxicity.
- **Nonhazardous**—Discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities.

The mercury management alternatives could have an impact on existing site waste management facilities. With the exception of some sanitary waste, waste management activities and facilities are limited to

collection and temporary storage of waste for offsite recycling, treatment, or disposal. Depending on the mercury storage location, leach fields, onsite treatment facilities, or municipal sewage treatment facilities are used for sanitary sewage.

E.3.2 Description of Impact Assessment

As shown in Table E-4, impacts were assessed by comparing the projected waste stream volumes generated from the proposed activities at each mercury management site with that site's waste management capacities and generation rates. It is expected that site waste management is limited to collecting the waste, preparing the waste for offsite disposal and temporarily (in the case of RCRA-regulated waste, less than 90 days) storing the waste pending offsite disposal. Projected waste generation rates for the proposed activities were compared with each site's capacity to manage the waste.

Table E-4. Impact Assessment Protocol for Waste Management

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Waste management capacity	RCRA Status	RCRA Status	Do additional hazardous waste generation or treatment activities change RCRA status?
Hazardous waste	Site generation rates (m ³ /yr) for each waste type	Generation rates (m ³ /yr) from activities associated with each proposed alternative for each waste type	Combination of waste generation volumes from activities associated with each proposed alternative and other site generation volumes in comparison to the capacities of applicable waste management facilities
Nonhazardous waste	Site management capacities (m ³) or rates (m ³ /yr) for potentially affected management facilities for each waste type		

E.4 SOCIOECONOMICS

E.4.1 Description of Affected Resources

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics of a region. The number of jobs created by the proposed action could affect regional employment, income, and expenditures. Job creation is characterized by two types: (1) construction-related jobs, transient in nature and short in duration, and thus less likely to impact public services; and (2) jobs related to facility operations, required for a longer period of time, and thus possibly creating additional service requirements in the region of influence.

The socioeconomic environment is made up of regional economic indicators and demographic characteristics of the area. Economic indicators include the labor force and unemployment rate. Demographic characteristics include population forecasts, housing, education, community safety, and health information.

E.4.2 Description of Impact Assessment

For each host county, data was compiled on current socioeconomic conditions, including unemployment rates and the civilian labor force. Census statistics were also compiled on population, housing demand, and community services. U.S. Bureau of the Census population forecasts for the regions of influence were combined with overall projected workforce requirements for each alternative considered at each

candidate site to determine the extent of impacts on economic characteristics, population, housing, and levels of community services (see Table E-5).

Table E-5. Impact Assessment Protocol for Socioeconomics

Table E-3. Impact Assessment Protocol for Socioeconomics			
Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Economic characteristics			
Workforce requirements	Site workforce projections from mercury management sites	Estimated facility modification and operating staff requirements and timeframes	Workforce requirements added to sites' workforce projections
Local civilian labor force	Labor force projections, based on U.S. Department of Labor estimates	Estimated facility modification and operating staff requirements and timeframes	Workforce requirements as a percentage of the local labor force
Unemployment rate	1999 and 2000 unemployment, based on U.S. Department of Labor estimates	Estimated facility modification and operating staff requirements	Projected change in unemployment rates
Population and housing			
Population	Latest available population projection estimates from the U.S. Bureau of the Census	Estimated facility modification and operating staff requirements and timeframes	Projected change in population projection
Housing—Percent of occupied housing units	Latest available rates from the U.S. Bureau of the Census	Estimated facility modification and operating staff requirements and timeframes	Projected change in housing units required
Community services			
Education	Latest available information from state or county estimates	Estimated facility modification and operating staff requirements and timeframes	Projected change in student population
Percent operating capacity for school districts in the region of influence			
Teacher-to-student ratio	Latest available information from local school districts or state and county estimates	Estimated facility modification and operating staff requirements and timeframes	Projected change to teacher-to-student ratio
Public safety—Ratio of police and firefighters to 100,000 residents	Latest available information from state or county public safety agencies	Estimated facility modification and operating staff requirements and timeframes	Projected change to police officer/firefighter to population ratio

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Health care Number of hospital beds and physicians per 100,000 residents	Latest available information from state and county or health care organization estimates	Estimated facility modification and operating staff requirements and timeframes	Projected change in hospital beds/physicians to population ratio

E.5 Risk

The risk assessment methods described in this appendix are summarized from the *Draft Risk Assessment Report* (DLA 2003). When discussing risk, it is convenient to divide the discussion into two parts: (1) facility and transportation accidents that provide the basis for accident risks and (2) risks associated with exposure of receptors (human and nonhuman) to toxic and hazardous materials, including mercury. In addition, the risks associated with accidents and the risks associated with normal operations will be segregated for clarity.

Because mercury exposure is a fundamental consideration for environmental impact analysis, it is important to know what characteristics of mercury strongly influence the risk analysis. Mercury in the Defense Nuclear Stockpile Center (DNSC) stockpile is elemental mercury. Elemental mercury can be inhaled, ingested, or absorbed through the skin. Ingestion of metal mercury is usually without effect; however, the inhalation of mercury vapor may cause irritation of the respiratory tract, renal disorders, central nervous system effects characterized by neurobehavioral changes, renal toxicity, peripheral nervous system toxicity, and death. Elemental mercury released into the environment may undergo transformations to its various forms and oxidation states, and these forms of mercury determine to a large degree its toxicity. Mercury is not a known human carcinogen.

This appendix describes the data and methods that were used to systematically estimate the impacts to human health and ecological receptors from normal operations and accidents associated with the alternatives for managing the mercury stockpile. This section is organized by facility risks, transportation risks, human health risks, and ecological risks. This parallels the discussion of risk impacts in the MM EIS and the *Draft Risk Assessment Report*.

E.5.1 Facility Accident Risks

Activities involving any hazardous material pose a risk of accidents impacting involved workers (i.e., workers directly involved in facility activities), noninvolved workers (i.e., workers on the site but not directly involved in facility activities), and members of the public. The consequences of such accidents can involve the release of hazardous material or hazardous energy sources beyond the intended confines of the facility. Risk is determined by the development of a representative spectrum of accidents, each of which is conservatively characterized by likelihood (i.e., expected frequency of occurrence) and a consequence. In addition, industrial accidents can result in injuries and fatalities independent of the material handled.

E.5.1.1 Description of Affected Resources

For the purposes of this analysis, involved workers are defined as workers in the immediate vicinity of the activity involved in the accident or site operations. Noninvolved workers are defined as workers located beyond 328 ft (100 m) from the facility but within the site boundary. Members of the public are defined as persons residing outside the site boundary and within 50 mi (80 km) of the facility.

E.5.1.2 Description of Impact Assessment

Accident risk analysis consists of several sequential steps:

- Identification and characterization of the hazards associated with specific operations involving mercury storage and handling and performance of a systematic evaluation of the postulated accident scenarios that may result from these hazards.
- Application of a ranking methodology for each postulated accident scenario to screen out low-risk accidents while indicating moderate or high-risk accidents that warrant additional quantitative analyses.
- Based on the accident selection process, accident scenarios identified as moderate or high risk receive further analysis. The accident analysis includes developing formal descriptions of accident scenarios, determining source terms, evaluating consequences due to atmospheric dispersion or other relevant pathways, estimating the likelihood of accident events, and comparing frequency and consequence categories to a specified risk matrix.

The final results from this process are estimates of risk for specific accidents associated with each alternative. Consequences are estimated in terms of an equivalent to the American Industrial Hygiene Association's Emergency Response Planning Guideline, Level 2 value for public receptors. The Emergency Response Planning Guideline, Level 2 represents the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective actions. For workers, the evaluation is based on the concentration that is immediately dangerous to life and health as provided by the National Institute for Occupational Safety and Health. These are acute human health effects and chronic health effects are discussed in Section E.5.3.

E.5.2 Transportation Risks

Transportation can cause risks to the public and to the environment, most of which are inherent in any transportation activity—air pollution, noise, and traffic congestion. Injuries and fatalities from vehicle collisions and the unexpected release of mercury due to transportation accidents represent additional risks to public health and the environment.

E.5.2.1 Description of Affected Resources

Transportation of mercury is only expected to involve surface (non-air) transport modes that include road (truck), rail, and oceangoing vessel and may also involve international transportation. To address the transportation risks, existing regulations of the U.S. Department of Transportation or the International Maritime Organization that govern packaging and transportation of hazardous materials would be followed.

E.5.2.2 Description of Impact Assessment

There is nothing inherently different in the transportation of mercury from the transportation of other goods in commerce. The impacts from transportation on public health and the environment were determined based on similar impacts from other non-accident transportation. The number of truckloads, railcar loads, or shiploads to transport all of the mercury was estimated. Based on this estimate, the amount of pollution and volume of carbon dioxide from engine exhaust were estimated from generally available numbers. Noise and traffic congestion were estimated as a percentage of increased traffic based on current traffic volume estimates. Road conditions and potential for their deterioration were based on existing conditions and expected traffic volumes. Transportation accident scenarios and potentially exposed populations and environments depended on the selected transport routes and modes. It was assumed that all transportation followed Federal, state, and local traffic regulations and rules.

Highway and railroad routes were selected using the Transportation Routing Geographic Information System operated by the U.S. Department of Energy's Oak Ridge National Laboratory. Ranges of mileage traversed were estimated based on full truckloads or full railcars of mercury flasks. The estimated total mileage of all shipments was multiplied by the accident rate from the U.S. Department of Transportation statistics to determine the number of expected accident fatalities and injuries. Also, the number of potential accidents severe enough to cause an unexpected, accidental release of mercury was estimated based on the estimated number of injury accidents. The consequence assessments were based on losing a fraction of the mercury contents during any such accident. Table E-6 shows the type and range of transportation risks.

In order to compare the environmental and public impacts of various transportation modes to each other and to the No Action Alternative, a risk assessment was performed. Conservatism was applied in defining the threshold for transportation incidents or accidents where mercury is released.

Recent mercury transport experience was reviewed to provide data and anecdotal confirmation of the relative safety of mercury transportation.

Table E-6. Impact Assessment Protocol for Transportation

Resource	Required Data		
	Affected Environment	Public Health/Environmental Impact	Measure of Impact
Increased air pollution	Population near local highways or railroads EPA nonattainment areas	Nitrogen oxides, carbon dioxide, and particulate matter emissions (ton/yr)	Pollutant concentrations exceed standards Potential for increased smog
Global warming	Existing U.S. carbon dioxide emissions (ton/yr)	Carbon dioxide releases (ton/yr)	Potential for increased greenhouse effect
Increased traffic congestion	Existing traffic levels on local roads/highway Existing road surface conditions	Number of employees and truck trips	Lower average speeds Road surface deterioration
Non-accident releases	Population near local highways or railroads	Drivers and loading/unloading workers Mercury emissions (kg/km)	Toxicity to workers and public from exposure to mercury

Resource	Required Data		Measure of Impact
	Affected Environment	Public Health/Environmental Impact	
Truck crash	Existing traffic along route Local population along route	Number of truck trips; route and distance traveled	Damage: accident per 10 ⁸ mi Injury: accident per 10 ⁸ mi Fatality: accident per 10 ⁸ mi Damage Injuries and fatalities Direct cost Cleanup costs
Rail crash	Existing rail traffic along route Local population along route	Number of train trips; route and distance traveled	Damage: accident per 10 ⁸ mi Injury: accident per 10 ⁸ mi Fatality: accident per 10 ⁸ mi Damage Injuries and fatalities Direct cost Cleanup costs
Oceangoing vessel accident	Existing ship traffic along route Local population around ports	Number of truck trips; route and distance traveled	Damage: accident per 10 ⁸ mi Injury: accident per 10 ⁸ mi Fatality: accident per 10 ⁸ mi Damage Injuries and fatalities Direct cost Cleanup costs

E.5.3 Human Health Risks

The following is a summary of methods that were used to investigate the potential for chronic (long-term) exposures. Conditions that necessitated an investigation of chronic health risk include:

- Accidents causing land or water contamination that could potentially lead to chronic exposures to contaminated food, water, or during recreational activities
- Chronic exposure pathways during storage and handling

The chronic human health risk assessment was conducted using methods recommended by EPA guidance in *Risk Assessment Guidance for Superfund (RAGS): Human Health Evaluation Manual, Part A* (EPA 1989a). The methods used to characterize risk are consistent with the following documents:

- *Exposure Factors Handbook* (EPA 1989b)
- *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors* (EPA 1991)
- *Dermal Exposure Assessment: Principles and Applications* (EPA 1992)

- *Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure, Draft* (EPA 1993)
- *Supplemental Guidance to RAGS: Region 4 Bulletins – Human Health Risk Assessment* (EPA 1995)
- RAGS: Human Health Evaluation Manuals Part D (EPA 1998)

E.5.3.1 Description of Affected Resources

The affected resources are outlined in Table E–7. At the facilities, these include involved workers (i.e., workers who work with the mercury at the facility), noninvolved workers (i.e., workers who work at the facility and are not involved in mercury operations), and the members of the public in the vicinity of the facilities. These populations may be affected both during normal operations and during accident situations. Transportation accidents can also result in pathways producing exposure and risk consequences to involved workers and the public.

Table E–7. Impact Assessment Protocol for Human Health Risk

Resource	Required Data		Measure of Impact
	Affected Environment	Facility Design	
Normal operations			
Onsite hazard from mercury exposure during normal operations	Potential pathways	Airborne release (mg/m ³) of mercury	Toxicity to workers
	Location and number of involved and noninvolved workers	Waterborne release of mercury (mg/kg or mg/l)	
	Exposure to existing contamination		
	Facility design, monitoring information, and emergency procedures		
Offsite hazard from mercury exposure during normal operations	Population density and distribution in the area surrounding the facility	Airborne release (mg/m ³) of mercury	Toxicity to public
	Exposure to existing contamination	Waterborne release of mercury (mg/kg or mg/l)	
	Maps or descriptions of surface features to determine possible pathways of release		
	Location of drinking water sources in relation to the site (private wells and groundwater)		
	Land use, including crops, livestock, and fishing that occur in the area surrounding the facility		

Resource	Required Data		Measure of Impact
	Affected Environment	Facility Design	
Facility accidents			
Onsite hazard from mercury exposure from facility accidents	Potential pathways	Accident frequency	Toxicity to workers
	Location and number of involved and noninvolved workers	Airborne release (mg/m ³) of mercury	
	Exposure to existing contamination	Waterborne release (mg/kg or mg/l)	
	Facility design, monitoring information, and emergency procedures		
Offsite hazard from mercury exposure from facility accidents	Potentially exposed receptors in offsite vicinity of facility	Accident frequency	Toxicity to humans in affected offsite environments
	Population density and distribution in the area surrounding the facility	Projected airborne release (mg/m ³)	
	Exposure to existing contamination	Projected waterborne release (mg/kg or mg/l)	
	Maps or descriptions of surface features to determine possible pathways of release		
	Location of drinking water sources in relation to the site (private wells and groundwater)		
	Land use, including crops, livestock, and fishing that occur in the area surrounding the facility		
Transportation accidents			
Local hazard from mercury exposure as a result of transportation accidents	Potentially exposed receptors along transportation routes	Nature of vehicles and quantities of mercury being transported	Toxicity to humans in affected environments
	Land use and population density that are likely to occur along potential transportation routes	Transportation accident frequency	
	Land use, including crops, livestock, and fishing that occur in the area along transportation routes	Airborne release (mg/m ³) of mercury as a result of accident	
		Release directly to soil (mg/kg) as a result of accident)	
		Release directly to water (mg/l) as a result of accident	

E.5.3.2 Description of Impact Assessment

The chronic human health risk assessment was organized into the following sections:

Exposure Assessment. Identification of potentially exposed receptors and potential exposure pathways; derivation of potential exposure point concentrations; and development of potential chemical intake or dose estimates.

Toxicity Assessment. Identification of reference dose for oral exposure to mercuric—an acceptable intake value for chronic exposure (noncancer effects).

Identification of reference concentration for inhalation exposure to elemental mercury—an acceptable intake value for chronic exposure (noncancer effects) via inhalation; this would be converted to an inhalation reference dose by multiplying by 706 ft³/day (20 m³/day) and dividing by 154 lb (70 kg).

Risk Characterization. Chronic daily intake divided by the reference dose to yield the hazard quotient. The hazard quotient is a measure of adverse noncancer effects. Hazard quotients may then be combined for each receptor and exposure pathway into a hazard index.

Uncertainty Analysis. Qualitative discussion of scenario uncertainty, which is missing or incomplete information needed to define the exposure scenario or pathway; model uncertainty, inability to quantify all assumptions in model variables; and parameter uncertainty, inadequate information to quantify an exposure variable or parameter.

E.5.4 Ecological Risks

Ecological risks impact the maintenance of ecological processes, such as providing ground cover, recycling biological materials, maintaining the clarity of streams, and producing food for ecological populations. Ecological risks were evaluated by calculating the exposure of appropriate receptor biota to the contaminants of potential concern. Receptors of concern for this evaluation are terrestrial and aquatic plants and animals. Threats to federally listed threatened and endangered species and state species of concern were also included in the ecological risk assessment.

As a result of accidents, concentrations of mercury in soil or water may exceed chronically toxic levels. Chronic toxicity occurs when receptors are exposed to contaminants over a period of time long enough to encompass at least one sensitive life stage, for example, reproduction.

Toxicity benchmarks were derived by assuming that mercury is taken up from soil, sediment, and surface water into biota that are themselves sensitive to toxic effects and are also part of the food web for various predators. A small number of receptors were chosen as representative receptors because their life style or food habits make them highly exposed to deposited mercury. They are terrestrial plants, earthworms, short-tailed shrew (*Blarina brevicauda*), American robin (*Turdus migratorius*), great blue heron (*Ardea herodias*), and aquatic biota. The lowest observed adverse effect levels for the chosen representative receptors taken from published toxicity data were used as toxicity endpoints, and accumulation modeling and life history of the receptors were used to calculate mercury screening values for soil and surface water. It was assumed that 2 percent of soil mercury and 1 percent of surface water mercury would be methylated. Total mercury values corresponding to the toxicity benchmarks of ionic mercury and methylmercury benchmarks were calculated, and the lower total mercury value for each receptor was chosen as the screening value. Those values are presented in Table E-8. Modeled soil, surface water, and sediment concentrations were compared to the screening benchmarks to determine which receptors might be at risk,

and if the benchmark is exceeded, the ratio of the exposure concentration and the benchmark used to indicate the magnitude of exposure above the benchmark.

Table E–8. Ecological Screening Values for Mercury in Soil and Surface Water

Receptor	Exposure Medium	Screening Value	
		Inorganic Mercury	Methyl Mercury
Plants	Soil	0.3 mg/kg	None
Earthworms	Soil	0.1 mg/kg	2.5 mg/kg
Short-tailed shrew	Soil	110 mg/kg	0.08 mg/kg
American robin	Soil	2 mg/kg	0.01 mg/kg
Red-tailed hawk	Soil	1,619 mg/kg	6.9 mg/kg
Great blue heron	Sediment	736 mg/kg	2.1 mg/kg
Great blue heron	Surface water	1.4 µg/l	0.03 µg/l
Aquatic biota	Surface water	1.3 µg/l	0.003 µg/l
Sediment-swelling biota	Sediment	0.15 mg/kg	None

E.5.4.1 Ecological Risk During Normal Operations

Ecological risks could occur during normal operations of mercury management activities. These risks could result from routine emissions of small quantities of hazardous constituents from storage and handling of mercury.

E.5.4.1.1 Description of Affected Resources

Ecological resources that could be impacted by normal operations are plants and soil invertebrates, small mammals, and songbirds in terrestrial habitats immediately surrounding the mercury management facilities. Plants and soil invertebrates, small mammals, songbirds, and higher predators in terrestrial habitats and aquatic and benthic biota in stream or pond habitats on site or off site are also potentially at risk from releases during normal operations.

E.5.4.1.2 Description of Impact Assessment

Estimates of releases from mercury management facilities were used to model risks. Routine emissions were evaluated by modeling the accumulation of mercury in soil, surface water, and sediment on site and off site. The approach to impact assessment is summarized in Table E–9.

Table E–9. Impact Assessment Protocol for Ecological Risk

Table 2-3: Impact Assessment Protocol for Ecological Risk			
Resource	Required Data		Measure of Impact
	Affected Environment	Facility Design	
Normal operations			
Onsite hazard from mercury exposure during normal operations	Habitat in onsite vicinity of facility, including drainage patterns	Airborne release (kg/yr) of mercury	Toxicity to biota in affected onsite terrestrial and aquatic environments
	Meteorological data		
Offsite hazard from mercury exposure during normal operations	Habitat in offsite vicinity of facility, including drainage patterns	Airborne release (kg/yr) of mercury	Toxicity to biota in affected offsite terrestrial and aquatic environments
	Meteorological data		
Facility accidents			
Onsite hazard from mercury exposure resulting from facility accidents	Habitat in onsite vicinity of facility, including drainage patterns	Projected airborne release (kg) as a result of accident	Toxicity to biota in affected onsite terrestrial and aquatic environments
	Meteorological data		
Offsite hazard from mercury exposure resulting from facility accidents	Habitat in offsite vicinity of facility, including drainage patterns	Projected airborne release (kg) as a result of accident	Toxicity to biota in affected offsite terrestrial and aquatic environments
	Meteorological data		
Transportation accidents			
Local hazard from mercury exposure as a result of transportation accidents	Habitats that are likely to occur along potential transportation routes, including potential drainage patterns	Nature of vehicles and quantities of mercury being transported	Toxicity to biota in affected terrestrial and aquatic environments
		Airborne release (kg) of mercury as a result of accident	
		Release directly to soil (kg) as a result of accident	
		Release directly to water (kg) as a result of accident	

E.5.4.2 Ecological Risk as a Result of Facility Accidents

Ecological risks could occur during facility accidents at mercury management facilities. These risks could result from emissions of hazardous constituents due to accidents.

E.5.4.2.1 Description of Affected Resources

Ecological resources that could be impacted by facility accidents are plants and soil invertebrates, small mammals, and songbirds in terrestrial habitats immediately surrounding the storage buildings. Plants and soil invertebrates, small mammals, songbirds, and higher predators in terrestrial habitats and aquatic and benthic biota in stream or pond habitats on site or off site are also potentially at risk from releases during facility accidents.

E.5.4.2.2 Description of Impact Assessment

Estimates of deposition to soil and surface water from airborne releases were made by using a Gaussian plume air dispersion/deposition model and projected airborne releases from the facility under the various accident scenarios. The highest soil and water concentrations on site and within 50 mi (80 km) of the storage buildings were used to model maximum risks to biota. The approach is summarized in Table E-9.

E.5.4.3 Ecological Risk as a Result of Transportation Accidents

Transportation is not expected to release mercury to the environment except in the case of accidents. The effects of accidents, including minor spills, accidental breach of flasks, and fires were evaluated. Section E.5.2 describes the transport modes (i.e., truck, rail, and ship) and accident scenarios that were evaluated. Releases that may occur as a result of transportation accidents were evaluated for both terrestrial and aquatic habitats that might be encountered along the transportation routes.

E.5.4.3.1 Description of Affected Resources

Ecological resources that could be impacted by transportation accidents are plants and soil invertebrates, small mammals, and songbirds in terrestrial habitats immediately surrounding the transportation routes. Plants and soil invertebrates, small mammals, songbirds, and higher predators in terrestrial habitats and aquatic and benthic biota in stream or pond habitats on site or off site are also potentially at risk from releases during transportation events.

E.5.4.3.2 Description of Impact Assessment

Estimates of direct deposition to soil and surface water as a result of transportation accidents were included in the accident analysis. Because environmental conditions and meteorological data were not available for all potential accident locations, the maximum accumulated concentrations predicted for transportation accidents were scaled from the release rates and maximum modeled accumulation from facility accidents. The approach is summarized in Table E-9.

E.6 GEOLOGY AND SOILS

E.6.1 Description of Affected Resources

Geologic resources include consolidated and unconsolidated earth materials, including mineral assets such as ore and aggregate materials, and fossil fuels such as coal, oil, and natural gas. Geologic conditions include hazards such as earthquakes, faults, volcanoes, landslides, sinkholes and other conditions leading to land subsidence, and unstable soils. Soil resources include the loose surface materials of the earth in which plants grow, usually consisting of mineral particles from disintegrating rock, organic matter, and soluble salts. Certain soils are important farmlands, which are designated by the U.S. Department of Agriculture Natural Resources Conservation Service. Important farmlands include prime farmland, unique farmland, and other farmland of statewide or local importance as defined in 7 CFR 657.5 and may be subject to the Farmland Protection Policy Act (7 U.S.C. 4201 et seq.).

Geology and soils were considered with respect to those attributes and geologic and soil resources that could be affected by the alternatives, as well as those geologic conditions that could affect each alternative, including associated facilities. The region of influence for geology and soils includes the

project site and nearby offsite areas subject to disturbance by mercury management activities during facility modification and operations and those areas beneath existing or new facilities that would remain inaccessible for the life of the facilities. Conditions that could affect the integrity and safety of the mercury management facilities under the alternatives include large-scale geologic hazards (e.g., earthquakes, volcanic activity, landslides, and land subsidence) and local hazards associated with the site-specific attributes of the soil and bedrock beneath site facilities. Thus, the area within which these geologic conditions exist is also used to define the region of influence for this resource area.

E.6.2 Description of Impact Assessment

Facility modification and operations for the mercury management alternatives were considered from the perspective of impacts on specific geologic resources and soil attributes. Facility modification activities were the focus of the impacts assessment for geologic and soil resources; hence, key factors in the analysis were the land area to be disturbed during construction and occupied during operations and the identification of unstable soils (i.e., soils prone to subsidence, liquefaction, shrink-swell, or erosion) (see Table E-10).

Table E-10. Impact Assessment Protocol for Geology and Soils

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Geologic hazards	Presence of geologic hazards within the region of influence	Location of facility	Potential for damage to facilities
Mineral and energy resources	Presence of any valuable mineral or energy resources within the region of influence	Location of facility	Potential to destroy or render resources inaccessible
Important farmland soils	Presence of prime farmland soils within the region of influence	Location of facility	Conversion of important farmland soils to non-agricultural use

The geology and soils impact analysis (Table E-10) also considered risks to the facilities (existing and modified) from large-scale geologic hazards such as faulting and earthquakes, lava extrusions and other volcanic activity, landslides, and sinkholes (i.e., conditions that tend to affect broad expanses of land). In general, the facility hazard assessment was based on the presence of any identified hazard and the distance of the facilities from it. This element of the assessment included collection of site-specific information on the potential for impacts on site facilities from local and large-scale geologic conditions. Historical seismicity within a given radius of each site was reviewed as a means of assessing the potential for future earthquake activity. As used in the MM EIS, earthquakes are described in terms of several parameters as presented in Table E-11. Probabilistic earthquake ground motions in terms of peak ground acceleration and response spectral acceleration were determined for each site in order to provide a comparative assessment of seismic hazard. Peak ground acceleration is indicative of what an object on the ground would experience during an earthquake and approximates what a short structure would be subjected to in terms of horizontal force. It does not account for the range of energies experienced by a building during an earthquake, particularly taller buildings. Measures of spectral acceleration account for the natural period of vibration of structures (i.e., short buildings have short natural periods [up to 0.6 seconds] and taller buildings longer periods [0.7 seconds or longer]) (USGS 2001c). Both parameters are used by the U.S. Geological Survey National Seismic Mapping Project. The U.S. Geological Survey's latest National Earthquake Hazards Reduction Program (NEHRP) maps are based on spectral acceleration and depict maximum considered earthquake ground motion of 0.2- and 1.0-second spectral acceleration, respectively, based on a 2 percent probability of exceedance in 50 years (i.e., corresponding to an annual probability of occurrence of about 1 in 2,500). The NEHRP maps have been adapted for use

Table E–11. The Modified Mercalli Intensity Scale of 1931, with Generalized Correlations to Magnitude, Earthquake Classification, and Peak Ground Acceleration

Modified Mercalli Intensity ^a	Observed Effects of Earthquake	Approximate Magnitude ^b	Class	Peak Ground Acceleration ^c (g)
I	Usually not felt except by a very few under very favorable conditions.	Less than 3	Micro	Less than 0.0017
II	Felt only by a few persons at rest, especially on the upper floors of buildings.	3 to 3.9	Minor	0.0017 to 0.014
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations similar to the passing of a truck.			
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy object striking building. Standing motorcars rock noticeably.	4 to 4.9	Light	0.014 to 0.039
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.			0.039 to 0.092
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	5 to 5.9	Moderate	0.092 to 0.18
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.	6 to 6.9	Strong	0.18 to 0.34
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned.	7 to 7.9	Major	0.34 to 0.65
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.			0.65 to 1.24
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.			1.24 and higher
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.	8 and higher	Great	
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.			

^a Intensity is a unitless expression of observed effects from earthquake-produced ground shaking. Effects may vary greatly between locations based on earthquake magnitude, distance from the earthquake, and local subsurface geology. The descriptions given are abbreviated from the Modified Mercalli Intensity Scale of 1931.

^b Magnitude is a logarithmic measure of the strength (size) of an earthquake related to the strain energy released by it. There are several magnitude “scales” (mathematical formulas) in common use including local “Richter” magnitude, body-wave magnitude, and surface wave magnitude. Each has applicability for measuring particular aspects of seismic signals and may be considered equivalent within each scale’s respective range of validity. For very large earthquakes, the newer moment magnitude scale provides the best overall measurement of earthquake size.

^c Acceleration is expressed as a percent relative to the earth’s gravitational acceleration (g) (i.e., g is equal to 980 centimeters per second squared). Given values are correlated to Modified Mercalli Intensity based on measurements of California earthquakes only (Ward et al. 1999).

Source: Compiled from USGS 2001a, USGS 2001b, and Ward et al. 1999.

in the new *International Building Code* (ICC 2000:fig. 1615[1] and [2]). The NEHRP maps were developed based on the recommendations of the Building Seismic Safety Council's Seismic Design Procedures Group (BSSC 2001a, 2001b). The Seismic Design Procedures Group-recommended maps, the maximum considered earthquake ground motion maps, are derived from the U.S. Geological Survey’s

probabilistic hazard maps with additional modifications that incorporate deterministic ground motions in selected areas and the application of engineering judgment (USGS 2002). Note that the maximum considered earthquake maps used in the *International Building Code* are based on a reference site condition (firm rock) and are suitable for determining estimates of maximum considered earthquake ground shaking for design purposes at most sites. For sites with non-reference conditions and for design of buildings requiring a higher degree of seismic safety, site-specific procedures must be used as contained in the *International Building Code* (BSSC 2001a:46).

An evaluation was also performed to determine if the modification or operation of mercury management facilities at a specific site could destroy, or preclude the use of, valuable mineral or energy resources.

Pursuant to the Farmland Protection Policy Act of 1981 (7 U.S.C. 4201 et seq.), and its implementing regulations, the presence of important farmland soils, including prime farmland was also evaluated. This act requires agencies to make Farmland Protection Policy Act evaluations part of the National Environmental Policy Act process, the main purpose being to reduce the conversion of farmland to nonagricultural uses by Federal projects and programs. However, otherwise qualifying farmlands in or already committed to urban development, land acquired for a project on or prior to August 4, 1984, and lands acquired or used by a Federal agency for national defense purposes are exempt from the act's provisions (7 CFR 658.2 and 658.3).

E.7 WATER RESOURCES

E.7.1 Description of Affected Resources

Water resources are the surface and subsurface waters that are suitable for human consumption, aquatic or wildlife propagation, agricultural purposes, irrigation, or industrial/commercial purposes. The region of influence used for water resources encompasses those surface water and groundwater systems that could be impacted by water withdrawals, effluent discharges, and spills or storm-water runoff associated with facility modification and operational activities under the mercury management alternatives.

E.7.2 Description of Impact Assessment

Determination of the impacts of the alternatives on water resources consisted of a comparison of site-generated data and professional estimates regarding water use and effluent discharge with applicable regulatory standards, design parameters and standards commonly used in the water and wastewater engineering fields, and recognized measures of environmental impact.

Certain assumptions were made to facilitate the impacts assessment: (1) all water supply (production and treatment) and effluent treatment facilities are approved by the appropriate permitting authority; (2) the effluent treatment facilities meet the effluent limitations imposed by the respective National Pollutant Discharge Elimination System (NPDES) permits; and (3) any storm-water runoff from facility modification or operations would be handled in accordance with the regulations of the appropriate permitting authority. It was also assumed that during any facility construction or modification, sediment fencing or other erosion control devices would be used to mitigate short-term adverse impacts from siltation, and that, as appropriate, storm-water holding ponds would be constructed to lessen the impacts of runoff on surface water quality.

E.7.2.1 Water Use and Availability

This analysis involved the review of engineering estimates of expected surface water and/or groundwater use and effluent discharge associated with facility modification and operations for each alternative, and the impacts on local and regional water availability in terms of quantity and quality. Impacts on water use and availability were generally assessed by determining changes in the volume of current water usage and effluent discharge as a result of the proposed activities (see Table E-12). For facilities intending to use surface water, no credit was taken for effluent discharges back to surface waters. The impact of discharging withdrawn groundwater to surface waters or back to the subsurface was also considered, as appropriate.

Table E-12. Impact Assessment Protocol for Water Use and Availability

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Surface water availability	Surface waters near the facilities, including average flow, low flow, and current usage	Volume of withdrawals from, and discharges to, surface waters	Changes in availability to local/downstream users of water for human consumption, irrigation, or animal feeding
Groundwater availability	Groundwater near the facilities, including existing water rights for major water users and current usage	Volume of withdrawals from, and discharges to, groundwater	Changes in availability of groundwater for human consumption, irrigation, or animal feeding

If the determination reflected an increase in water use or effluent discharge, then an evaluation of the design capacity of the water production and treatment facilities and the effluent treatment facilities, respectively, was made to determine whether the design capacities would be exceeded. If the combined flow (i.e., the existing flow plus that from the proposed activities) was less than the design capacity of the water supply systems and effluent treatment plants, then it was assumed that there would be no impact on water availability for local users, or on receiving surface waters or groundwater from effluent discharges. Further, a separate analysis (see below) was performed as necessary to determine the potential for impacts of mercury management activities on ambient surface water or groundwater quality, based in part on the results of the effluent treatment capacity analysis.

Because water withdrawals and effluent discharges from the site facilities were generally found not to exceed the design capacity of existing water supply systems or effluent treatment facilities, additional analyses were not performed for these activities.

E.7.2.2 Water Quality

The water quality impact assessment for the MM EIS analyzed how effluent discharges and nonroutine releases (e.g., spills) to surface water, as well as discharges reaching groundwater, from the mercury management facilities under each alternative could affect current water quality. The impacts of the alternatives were assessed as summarized in Table E-13 and included a comparison of the projected effluent quality with relevant regulatory standards and implementing regulations such as the Clean Water Act, Safe Drinking Water Act, state laws, and existing site permit conditions. The impact analyses evaluated the potential for contaminants to affect receiving water quality as a result of spills and other releases under the alternatives. Separate analyses were conducted for surface water and groundwater impacts.

Table E–13. Impact Assessment Protocol for Water Quality

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Surface water quality	Surface waters near the facilities in terms of stream classifications and changes in water quality	Expected contaminants and contaminant concentrations in discharges to surface waters	Exceedance of relevant surface water quality criteria or standards under the Clean Water Act or state regulations and existing permits
Groundwater quality	Groundwater near the facilities in terms of classification, presence of designated sole source aquifers, and changes in quality of groundwater	Expected contaminants and contaminant concentrations in discharges that could reach groundwater	Contaminant concentrations in groundwater exceeding relevant standards or criteria established in accordance with the Safe Drinking Water Act or state regulations and or existing permits

Surface Water Quality. The evaluation of surface water quality impacts focused on the quality and quantity of any effluents (including storm water) to be discharged, as well as other releases, and the quality of the receiving stream upstream and downstream from the discharges. The evaluation of effluent quality featured review of the expected parameters, such as the expected average and maximum flows, as well as the effluent parameters reflected in any existing or expected NPDES or applicable state or local discharge permits. Parameters of concern include total suspended solids, metals, organic and inorganic chemicals, and any other constituents that could affect the local environment. Any proposed water quality management practices were reviewed to ensure that any applicable permit limitations and conditions would be met. Factors that currently degrade water quality were also identified.

During facility modifications that result in ground disturbance, surface waters could be affected by construction site runoff and silting. Such impacts relate to the amount of land disturbed, the type of soil at the site, the topography, and weather conditions. They would be minimized by application of standard management practices for storm water and erosion control (e.g., sediment fences, mulching disturbed areas).

During operations, surface waters could be affected by increased runoff from parking lots, buildings, or other cleared areas. Storm water from these areas could be contaminated with materials deposited by airborne pollutants, automobile exhaust and residues, materials handling releases (such as spills), and process effluents. Impacts of storm-water discharges could be highly variable and site specific, and mitigation would depend on management practices, the design of holding facilities, the topography, and adjacent land use. Data from existing water quality databases were compared with expected discharges from the facilities to determine the potential for and the relative impacts on surface waters.

Groundwater Quality. Potential groundwater quality impacts associated with effluent discharges and other contaminant releases during facility modifications and operations were examined. Available engineering estimates of contaminant concentrations were weighed against applicable Federal and state groundwater quality standards, effluent limitations, and drinking water standards to determine the impacts of each alternative. Also evaluated were the consequences of groundwater use and effluent discharge on other site groundwater conditions.

E.7.2.3 Waterways and Floodplains

The locations of waterways (e.g., ponds, lakes, streams) and 100- and 500-year floodplains were identified from maps and other existing documents to assess the potential for impacts from facility modification and operations including direct effects on hydrologic characteristics or secondary effects such as silting (see Surface Water Quality). For any facility proposed for location in a floodplain, a floodplain assessment would be prepared, as necessary. All activities would be conducted to avoid delineated floodplains and to ensure compliance with Executive Order 11988, "Floodplain Management."

E.8 ECOLOGICAL RESOURCES

E.8.1 Description of Affected Resources

Ecological resources include terrestrial and aquatic resources (plants and animals), threatened and endangered species, and wetlands that could be affected by the mercury management alternatives. The region of influence used for habitat impacts encompassed the area potentially disturbed by facility modification and operations.

E.8.2 Description of Impact Assessment

The proposed alternatives could involve land disturbance during facility modifications (see Table E-14). Accordingly, ecological impacts were assessed in terms of potential disturbances or loss of nonsensitive terrestrial and aquatic habitats and the potential effects on nearby sensitive habitats.

For the purposes of the MM EIS, nonsensitive terrestrial resources are defined as those plant and animal species and communities that are most closely associated with the land; for nonsensitive aquatic resources, a water environment. Sensitive habitats include those areas occupied by threatened and endangered species, state-protected species, and wetlands. Endangered species are defined under the Endangered Species Act of 1973 as those in danger of extinction throughout all or a large portion of their range. Threatened species are defined as those species likely to become endangered within the foreseeable future. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service propose species to be added to the lists of threatened and endangered species. They also maintain a list of candidate species for which they have evidence that listing may be warranted but for which listing is currently precluded by the need to list species more in need of Endangered Species Act protection. Candidate species do not receive legal protection under the Endangered Species Act, but should be considered in project planning in case they are listed in the future. Critical habitat for threatened and endangered species is designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service. Critical habitat is defined as specific areas that contain physical and biological features essential to the conservation of species and that may require special management consideration or protection (16 U.S.C. 1532). States may also designate species as endangered, threatened, sensitive protected, in need of management, of concern, monitored, or species of special concern.

Wetlands are defined by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR 328.3).

Table E–14. Impact Assessment Protocol for Ecological Resources

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Nonsensitive			
Terrestrial resources	Vegetation and wildlife within the vicinity of facilities	Area disturbed by facility modification, air and water emissions, and noise	Loss or disturbance to terrestrial habitat; emissions and noise values above levels shown to cause impacts to terrestrial resources
Aquatic resources	Aquatic resources within the vicinity of facilities	Facility air and water emissions, water source and quantity, and wastewater discharge location and quantity	Discharges above levels shown to cause impacts to aquatic resources
Sensitive			
Threatened and endangered species	Threatened and endangered species within the vicinity of facilities	Area disturbed by facility modification, air and water emissions, noise, water source and quantity, and wastewater discharge location and quantity	Determination by U.S. Fish and Wildlife Service and state agencies that facility modification and operations could disturb sensitive habitats
Wetlands	Wetlands within the vicinity of facilities	Area disturbed by modification, air and water emissions, and wastewater discharge location and quantity	Loss or disturbance to wetlands

E.8.3 Nonsensitive Habitat Impacts

During facility modification, ecological resources could be affected through disturbance or loss of habitat resulting from land disturbance, human intrusion, and noise. Terrestrial resources could be directly affected through changes in vegetative cover important to individual animals of certain species with limited home ranges, such as small mammals and songbirds. Likely impacts include increased direct mortality and susceptibility to predation. Activities associated with the modification and operation of facilities (e.g., human intrusion and noise) could also compel the migration of the wildlife to adjacent areas with similar habitat. If the receiving areas were already supporting the maximum sustainable wildlife, competition for limited resources and habitat degradation could be fatal to some species. Therefore, the analysis of impacts on terrestrial wildlife was based largely on the extent of plant community loss or modification.

Modification of facilities and the operation thereof, could directly affect aquatic resources through increased runoff and sedimentation, increased flows, and the introduction of chemical changes to the water. Impacts to nonsensitive terrestrial and aquatic ecosystems from water use and air and water emissions were evaluated based on the results of analyses conducted for air quality and water resources. However, various mitigation techniques should minimize facility modification impacts, and discharges of contaminants to surface waters and air from routine operations are expected to be limited by engineering control practices.

E.8.4 Sensitive Habitat Impacts

Impacts on threatened and endangered species, state-protected species, and their habitats during modification of facilities were determined in a manner similar to that for nonsensitive habitats. A list of sensitive species that could be present at each site was compiled. Informal consultations were initiated with the appropriate U.S. Fish and Wildlife Service offices and state-equivalent agencies as part of the impacts assessment for sensitive species.

Most facility modification impacts on wetlands are related to the displacement of wetlands by filling, draining, or dredging activities. Loss of wetlands resulting from modification of the facilities was addressed by comparing data on the location and area extent of wetlands in the region of influence with the land area requirements for the proposed alternatives. Operational impacts thereon could result from effluents, surface water or groundwater withdrawals, or creation of new wetlands.

E.9 CULTURAL RESOURCES

E.9.1 Description of Affected Resources

Cultural resources are the indications of human occupation and use of property as defined and protected by a series of Federal laws, regulations, and guidelines. For the MM EIS, potential impacts were assessed separately for each of the cultural resources categories: prehistoric, historic, and Native American.

Prehistoric resources are the physical remains of human activities that predate written records. They generally consist of artifacts that may alone or collectively yield inaccessible information about the past. Historic resources consist of physical remains that postdate the emergence of written records; in the United States, they are architectural structures or districts, archaeological objects, and archaeological features dating from 1492 and later. Ordinarily, sites less than 50 years old are not considered historic, but exceptions can be made for such properties if they are of particular importance, such as structures associated with World War II or Cold War themes. Native American resources are sites, areas, and materials important to Native Americans for religious or heritage reasons. Such resources may include geographical features, plants, animals, cemeteries, battlefields, trails, and environmental features. The region of influence for cultural resource analysis encompasses the area that would potentially be disturbed by modification and occupation during the operation of the mercury management facilities.

E.9.2 Description of Impact Assessment

The analysis of impacts to cultural resources addressed potential direct and indirect impacts at each candidate site (Table E-15).

Potential indirect impacts include those associated with reduced access to a resource site, as well as impacts associated with increased traffic and visitation to sensitive areas. Direct impacts include those resulting from ground disturbing activities associated with construction or modification of facilities for mercury management. Consultations to comply with Section 106 of the National Historic Preservation Act will be conducted with the various State Historic Preservation Officers. Consultations will also be conducted with interested Native American tribes.

Table E–15. Impact Assessment Protocol for Cultural Resources

Table E-13: Impact Assessment Protocol for Cultural Resources			
Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Cultural			
Prehistoric and historic resources	Prehistoric and historic resources within the vicinity of facilities	Location of facility on the site	Potential for loss, isolation, or alteration of the character of prehistoric and historic resources; introduction of visual, audible, or atmospheric elements out of character; neglect of resources listed or eligible for listing on the National Register of Historic Places
Native American resources	Native American resources within the vicinity of facilities	Location of facility on the site	Potential for loss, isolation, or alteration of the character of Native American resources; introduction of visual, audible or atmospheric elements out of character

E.10 LAND USE AND VISUAL RESOURCES

E.10.1 Land Use

E.10.1.1 Description of Affected Resources

Land use includes the land on and adjacent to each candidate site, the physical features that influence current or proposed uses, pertinent land use plans and regulations, and land ownership and availability. The region of influence for land use varies due to the extent of land ownership, adjacent land-use patterns and trends, and other geographic or safety considerations.

E.10.1.2 Description of Impact Assessment

The amount of land disturbed and conformity with existing land use were considered in order to evaluate potential impacts (see Table E–16). The MM EIS evaluates the impacts of mercury management alternatives on land use within each candidate site, adjacent Federal or state lands, adjacent communities, and wildlife or resource areas. The analysis focuses on the net land area affected, its relationship to conforming and nonconforming land uses, current growth trends, and other factors pertaining to land use. Land-use impacts could vary from site to site, depending on existing facility land-use configurations, adjoining land uses, and proximity to residential areas.

Table E–16. Impact Assessment Protocol for Land Use and Visual Resources

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Land area used	Site acreage	Facility acreage requirement	Acreage converted to project use
Compatibility with existing or future land use	Existing land-use configurations	Location of facility on the site; expected modifications of site activities and missions to accommodate the alternatives	Incompatibility with existing or future land use
Visual resources	Current Visual Resource Management classification	Location of facility on the site; facility dimensions and appearance	Change in Visual Resource Management classification

Evaluation of existing land use at each of the potentially affected sites entailed review of available facility land-use plans. Where land adjacent to the candidate site is managed by local government, applicable community general plans, zoning ordinances, and population growth trend data were reviewed. Where such land is managed under the jurisdiction of a Federal or state land management agency, the respective agency resource management plans and policies were reviewed. Compatibility of land use associated with airports was also considered. Although the Air Installation Compatible Use Zone (AICUZ) program for minimizing development that would be incompatible with aviation operations only applies to military airfields, the Federal Aviation Administration has established similar land-use criteria for civilian airfields. However, these criteria deal more with flight obstruction hazards rather than the potential hazards associated with the nearby transport or storage of hazardous materials such as mercury.

Total additional land area requirements include those areas to be occupied by the footprint of facility modifications in conjunction with any additional paved roads, parking areas, graveled areas, construction laydown areas, as well as land graded and cleared of vegetation in order to support the proposed action.

E.10.2 Visual Resources

E.10.2.1 Description of Affected Resources

Visual resources are the natural and human-created features that give a particular landscape its character and aesthetic quality. Landscape character is determined by the visual elements of form, line, color, and texture. All four elements are present in every landscape; however, they exert varying degrees of influence. The stronger the influence exerted by these elements in a landscape, the more interesting the landscape. The region of influence for visual resources includes the geographic area from which the mercury management facilities may be seen.

E.10.2.2 Description of Impact Assessment

Impacts to visual resources may be determined by evaluating whether or not the Bureau of Land Management Visual Resource Management classifications of the candidate sites would change as a result of mercury management activities (DOI 1986) (see Table E–16). Existing classifications were derived from an inventory of scenic qualities, sensitivity levels, and distance zones for particular areas. The elements considered in association with scenic quality include landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modification. Sensitivity levels are determined by user volumes and user attention. Distance zones concern the visibility from travel routes or observation points.

The visual resources analysis focuses on the degree of contrast between the proposed action and the surrounding landscape, the location and sensitivity levels of public vantage points, and the visibility of the proposed action from the vantage points. The distance from a vantage point to the affected area and atmospheric conditions were also taken under consideration, as distance and haze can diminish the degree of contrast and visibility. A qualitative assessment of the degree of contrast between proposed facility modification and operations and the existing visual landscape is presented, as applicable.

E.11 INFRASTRUCTURE

E.11.1 Description of Affected Resources

Site infrastructure includes physical resources required to support the construction and operation of facilities. It includes the capacities of the onsite road and rail transportation networks; electric power and electrical load capacities; natural gas, coal, and fuel oil capacities; and water supply system capacities.

The region of influence is generally limited to the boundaries of the candidate sites. However, should infrastructure requirements exceed site capacities, the region of influence would be expanded (for analysis) to include the sources of additional supply. For example, if electrical demand (with added facilities) exceeded site availability, then the region of influence would be expanded to include the likely source of additional power (i.e., the power pool currently supplying the site).

E.11.2 Description of Impact Assessment

In general, infrastructure impacts were assessed by evaluating the requirements of each alternative against site capacities. An impact assessment was made for each resource (road networks, rail interfaces, electricity, fuel, and water) for the various alternatives (see Table E-17). Tables reflecting site availability and infrastructure requirements were developed for each alternative. Data for these tables were obtained from reports describing the existing infrastructure at the sites, and from data obtained directly from each facility. If necessary, design mitigation considerations conducive to reduction of the infrastructure demand were also identified.

Table E-17. Impact Assessment Protocol for Infrastructure

Table E-17: Impact Assessment Protocol for Infrastructure			
Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Transportation			
Roads (mi)	Site capacity and current usage	Facility requirements	Site capacity exceeded
Railroads (mi)			
Electricity			
Energy consumption (MWh/yr)	Site capacity and current usage	Facility requirements	Site capacity exceeded
Fuel			
Natural gas (ft³/yr)	Site capacity and current usage	Facility requirements	Site capacity exceeded
Oil (gal/yr)			
Coal (ton/yr)			
Gasoline (gal/yr)			
Water (gal/yr)	Site capacity and current usage	Facility requirements	Site capacity exceeded

Any projected demand for infrastructure resources exceeding site availability can be regarded as an indicator of impact. Whenever projected demand approaches or exceeds capacity, further analysis for that resource is warranted. Often, design changes can mitigate the impact of additional demand for a given resource. For example, substituting fuel oil for natural gas (or vice versa) for heating or industrial processes can be accomplished at little cost during the design of a facility, provided the potential for impact is identified early. Similarly, a dramatic “spike” in peak demand for electricity can sometimes be mitigated by changes to operational procedures or parameters.

E.12 ENVIRONMENTAL JUSTICE

The environmental justice analysis evaluated the potential for disproportionately high and adverse impacts on low-income or minority populations that could result from implementation of the alternatives. Incident-free storage, processing, and transportation activities are unlikely to have a significant effect on the general public. Thus, the environmental justice analysis focused on potential health risks resulting from accidents that could occur during activities associated with implementation of the alternatives for mercury management. Low-income and minority populations-at-risk are composed of low-income and minority portions of the general population subject to mercury exposures that could result from such accidents. Consequences and risks are identical to those used in health impacts analysis.

The Council on Environmental Quality issued its guidance for evaluation of environmental justice in December 1997, *Environmental Justice Guidance Under the National Environmental Policy Act* (www.whitehouse.gov/CEQ/). The Council’s guidance was used as the basis for this evaluation of environmental justice (see Table E–18).

Table E–18. Impact Assessment Protocol for Environmental Justice

Resource	Required Data	
	Affected Environment	Measure of Impact
Minority populations	Latest baseline demographic data from the 2000 census with block resolution from TigerLine 2000 files	<p>Disproportionately high and adverse toxicity risk due to mercury inhalation impacting minority populations. Airborne concentrations of mercury exceed 300 ng/m³.</p> <p>Disproportionately high and adverse toxicity risk due to mercury ingestion impacting minority populations. Ingestion benchmarks for exposure to organic or inorganic mercury are 300 ng/kg/day (mercuric chloride); 100 ng/kg/day (methyl mercury); and 300 ng/m³ (elemental mercury).</p>
Low-income populations	Latest baseline demographic data with block group resolution from the U.S. Census Bureau’s Summary File 3	<p>Disproportionately high and adverse toxicity risk due to mercury inhalation impacting minority populations. Airborne concentrations of mercury exceed 300 ng/m³.</p> <p>Disproportionately high and adverse toxicity risk due to mercury ingestion impacting minority populations. Ingestion benchmarks for exposure to organic or inorganic mercury are 300 ng/kg/day (mercuric chloride); 100 ng/kg/day (methyl mercury); and 300 ng/m³ (elemental mercury).</p>

E.12.1 Description of Affected Resources

The following definitions were used in this analysis of environmental justice:

- **Minority individuals**—Individuals who are members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, two or more races (at least one of which is a minority race). This definition is similar to that given in the Council on Environmental Quality's environmental justice guidance (CEQ 1997), except that it has been modified to reflect "Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity" (62 FR 58782), published by the Office of Budget and Management. These revisions were adopted and used by the Bureau of the Census in collecting data for the 2000 census. As discussed in Appendix G, Environmental Justice, racial and ethnic data from the 1990 census cannot be directly compared with that from the 2000 census.

The Office of Management and Budget has also recommended that persons self-identified as multiracial should be counted as a minority individual if one of the races is a minority race (OMB 2000). During the 2000 census, approximately 2 percent of the population identified themselves as members of more than one race (Grieco and Cassidy 2001). Approximately two-thirds of those designated themselves as members of at least one minority race.

- **Minority population**—Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In identifying minority communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another or a geographically dispersed and transient set of individuals (such as migrant workers or American Indian/Alaska Native), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected minority population. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds.
- **Low-income individual**—Person whose self-reported income is below the poverty threshold adopted by the Census Bureau.
- **Low-income population**—The total number of low-income individuals residing within a potentially affected area.

In the discussions of environmental justice in the MM EIS, persons self-designated as Hispanic or Latino are included in the Hispanic or Latino population, regardless of race. For example, the Asian population is composed of persons self-designated as Asian and not of Hispanic or Latino origin. Asians who designated themselves as having Hispanic or Latino origins are included in the Hispanic or Latino population.

Minority populations residing in potentially affected areas were determined from the 2000 census data. The data are available from SF1 and Tiger/Line files published by the U.S. Bureau of the Census (www.census.gov). Projections of minority populations were based on population projections published

by the Census Bureau (Campbell 1996). Low-income populations in potentially affected areas for the year 1990 were calculated using Table P121 of Standard Tape File 3A. Low-income populations for the year 2000 will be included in the Final MM EIS if the data are available from the Census Bureau in time for inclusion in the environmental justice analysis.

E.12.2 Description of Impact Assessment

The analysis of environmental justice used block spatial resolution. Demographic data are aggregated by the Census Bureau in a variety of ways that include states, counties, census tracts, block groups, and blocks. Blocks provide the finest spatial resolution available for evaluation of minority populations. It is rare that the boundaries of blocks coincide with boundaries of areas potentially affected by implementation of the alternatives. As a result, some blocks will lie partly inside and partly outside of the potentially affected area. In order to estimate the population at risk residing in partially included blocks, it was assumed that the population of partially included blocks is uniformly distributed within block boundaries. Thus, if “X” percent of a block lies within the potentially affected area, then it is assumed that “X” percent of the population of that block is at risk. An upper bound for the potentially affected population was obtained by assuming that the entire population of partially included blocks would be at risk. A lower bound for the potentially affected population was obtained by assuming that none of the population in partially included blocks would be at risk.

Had the analysis shown that implementation of the alternatives would result in significant and adverse health or other environmental impacts on the general population, then additional analysis would have been conducted to determine whether the impacts disproportionately affected low-income or minority populations.

E.13 CUMULATIVE IMPACTS

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). The cumulative impact analysis for the MM EIS involved combining the impacts of the alternatives (including No Action) with the impacts of other present and reasonably foreseeable activities in the region of influence. The regions of influence for different resources can vary widely in extent. For example, the region of influence for ecological resources would generally be confined to the site and nearby adjacent areas, whereas the socioeconomic region of influence would include the cities and counties surrounding each site that could be affected by the proposed action.

In general, cumulative impacts were calculated by adding the values for the baseline affected environment (i.e., conditions attributable to past and present actions by DNSC and other public and private entities), the proposed action, and other future actions. This cumulative value was then weighed against the appropriate impact indicators (e.g., regulatory standards or limits) to determine the potential for impact. The selected indicators of cumulative impacts evaluated in the MM EIS are shown in Table E-19.

The analysis focused on the potential for cumulative impacts at each site from DNSC actions under consideration at the time of the MM EIS, as well as cumulative impacts associated with transportation between the sites and between the sites and the processing, storage, and disposal locations. Table E-20 lists other present and reasonably foreseeable actions considered in the cumulative impact assessment. Non-DNSC actions were also considered where information was readily available. Public documents prepared by agencies of Federal, state, and local governments were the primary sources of information for non-DNSC actions.

Table E–19. Selected Indicators of Cumulative Impact

Category	Indicator
Resource use	Land occupied compared with local land availability Electricity use compared with local capacity Water use compared with local capacity Workers required compared with local workforce
Air quality	Criteria pollutant concentrations compared with standards Hazardous pollutant concentrations compared with standards
Human health	<u>Public</u> : Toxic substance concentrations compared with mercury exposure limits <u>Workers</u> : Toxic substance concentrations compared with mercury exposure limits
Waste	Hazardous waste generation rate compared with local generation rate and/or capacity Nonhazardous waste generation rate compared with local generation rate and/or capacity
Ecology	Habitat disturbed compared with remaining habitat
Transportation	Number of truck trips compared with local truck traffic Predicted additional traffic fatalities compared with local rates

Table E–20. Other Present and Reasonably Foreseeable Actions Considered in the Cumulative Impact Assessment

Activities	New Haven	Somerville	Warren	Y–12	PEZ Lake	Utah
CERCLA Site Investigations (USACE 2000a, 2000b, 2000c)	X	X	X			
<i>Final EIS Disposal and Reuse of the BRAC Parcel at Tooele Army Depot</i> (Army 1996)						X
<i>EIS for BRAC 95 Disposal and Reuse of Property at the Seneca Army Depot</i> (Army 1998)					X	
<i>EA for the Mid-Valley Highway Right-of-Way Through Tooele Army Depot</i> (Army 2001a)						X
<i>EA for the Utah Industrial Depot West Loop Road Right-of-Way Through Tooele Army Depot</i> (Army 2001b)						X
<i>Supplemental Draft EIS, Seneca County Public Safety Building and Jail at the Seneca Army Depot</i> (Chazen 2002)					X	
Route 206 Bypass (NJDOT 1999, 2002)		X				
Warren Outerbelt Freeway (Newbrough 2001)			X			
<i>Y–12 Site-Wide EIS</i> (DOE 2001) ^a				X		

^a The *Y–12 Site-Wide EIS* provides a comprehensive evaluation of cumulative impacts at the Y–12 National Security Complex.

Key: BRAC, U.S. Army Base Realignment and Closure; CERCLA, Comprehensive Environmental Response, Compensation, and Liability Act; EA, environmental assessment; EIS, environmental impact statement; Y–12, U.S. Department of Energy's National Security Complex.

It is assumed that construction and modification impacts would not be cumulative because construction is typically short in duration, and construction impacts are generally temporary. Further, most construction would likely be limited to internal modifications to existing facilities. Closure and demolition of the storage buildings was not addressed in the cumulative impact estimates. Given the uncertainty regarding the timing of closure and demolition, any impact estimate at this time would be speculative.

E.14 COST ANALYSIS METHODOLOGY

The MM EIS evaluated the costs associated with each of the proposed alternatives: No Action, Consolidated Storage, Sales, or a combination thereof. In the No Action Alternative, costs were estimated for continuing to store the mercury at its current storage locations while in others, costs were estimated for transporting the mercury to a consolidation site and then storing it. The MM EIS also evaluated alternatives where the mercury is sold, thereby generating revenues that could help to offset the costs associated with implementing these alternatives.

The cost of each alternative was evaluated using the following methodology. The annual costs associated with storing and inspecting the mercury at each of its current storage locations was collected from the storage depots. Periodic costs associated with continuing to store the mercury at these locations were estimated based on discussions with depot personnel, DLA headquarters, and any anticipated commercial service providers. The total cost of the alternative was estimated by multiplying the annual projected storage cost by the number of years being considered for storage and adding in any one-time costs.

Consolidation alternatives involve the transport of mercury to one of the four current storage locations or to another facility. These alternatives may call for building improvements and overpacking the mercury flasks at Y-12. Building improvements and overpacking costs were estimated based on discussions with DLA representatives. Transportation costs were estimated by consulting mercury industry professionals. The total cost includes packaging, transportation, and storage.

Alternatives for selling mercury include selling at the maximum market allowable rate or to a mercury mining company to reduce mining. In any case the objective would be to reduce the stockpile of mercury, while limiting the impact on incumbent mercury buyers and sellers. By selectively selling at specific quantities of mercury to acceptable buyers, effects on the market price of mercury can be limited. This requires knowledge of historical demand, supply, and prices. The U.S. Geological Survey and industry journals were a source of market data, determining the appropriate quantity and price of mercury to be sold. In some cases, the price of mercury sold may be affected by certain stipulations governing its use, possibly lowering the selling price of the mercury. Total costs for these alternatives included the cost to package the material for shipment. For all of the proposed alternatives, costs were presented in 'current year dollars' and 'then year dollars,' assuming an appropriate inflation rate over the life of the proposed action.

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